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Paper on Measurement of the Nanomechanical Properties of Thin Films Using AFAM Receives Recognition

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PAPER ON MEASUREMENT OF THE NANOMECHANICAL PROPERTIES OF THIN FILMS USING AFAM RECEIVES RECOGNITION

NIST researchers are developing atomic force acoustic microscopy (AFAM) methods to quantitatively determine the elastic properties of thin films. The AFAM technique measures the frequencies of an atomic force microscope (AFM) cantilever's first two flexural resonances while in contact with a material. The indentation modulus, M, of an unknown or test material can then be obtained by comparing the resonant spectra of the test material to those of a reference material. To examine metrology issues for this emerging technique, AFAM results have been compared with those obtained by other methods, such as instrumented indentation. The results show that better agreement may be achieved by averaging results from two different reference materials, providing better insight into using AFAM methods to attain reliable, accurate measurements of elastic properties on the nanoscale.

A conference paper on this subject, entitled "Quantitative Elastic-Property Information with Acoustic AFM: Measurements and Modeling," by NIST's Donna Hurley and Paul Rice, Joseph Turner (University of Nebraska-Lincoln) and Joshua Wiehn (former Nebraska graduate student), was recently awarded Second Best Paper for the SPIE 2002 Symposium on NDE and Health Monitoring. The topic was also the subject of an invited colloquium at the Fraunhofer Institute for Nondestructive Testing (Saarbruecken, Germany) last autumn.

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MICROWAVE MEASUREMENT TECHNIQUE DEVELOPED BY NIST RESEARCHER ADOPTED BY COMMERCIAL INSTRUMENT MANUFACTURER

A measurement method developed by a NIST researcher is now being widely used in the microwave industry. The method for measuring equivalent source match, published in the October 1997 issue of *Microwave Journal*, enables more accurate power measurements. The method has been adopted by a number of national laboratories and companies. The most recent example is an application note published by a manufacturer of microwave equipment that describes the technique in detail. The application note points out that the uncertainty in the calibration of power meters can be reduced by one order of magnitude when the technique is used to correct for source and power meter mismatches.

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PROPOSED NIST DISTRIBUTED TESTBED FOR FIRST RESPONDERS

Over the past several months, NIST has been working on novel communications and networking technologies for first responders at disaster sites. The goal of the NIST Distributed Testbed for First Responders is to save lives during natural or man-made emergencies by equipping first responders with highly capable systems and gear, based on the latest technological advances. Research in the Advanced Network Technologies Division has contributed to the NIST Distributed Testbed for First Responders in the following ways:

• NIST researchers built a wireless ad hoc network (WANET) consisting of Compaq iPAQ Personal Digital Assistants (PDAs) running on the Linux operating system and equipped with IEEE 802.11b wireless local area network (WLAN) cards. The network demonstrates how first responders could communicate with each other and with those outside of their WANET at an emergency site. Requiring no prior infrastructure, the network self-organizes once the first responders converge on a disaster site. It reorganizes automatically every time a node leaves the network (perhaps due to destruction or to the physical departure of the person carrying the associated radio/handheld terminal). As such, the network is resilient to node and link failures, and its performance degrades gracefully in the face of such events.

The network uses multihop communications to carry all sorts of traffic, such as full-duplex voice, video, text, and sensor data. Any message to be transmitted from node A to node B may go through several intermediary nodes. This helps conserve the battery power at each node, reducing interference for other communications taking place throughout the network and increasing the traffic-carrying capacity of the network. ITL's use of the IEEE 802.11b technology in the testbed is for proof-of-concept purposes. Future standards for first responder communications and networking will be based on other varieties of wireless technology.

• NIST developed a method by which the WANET could determine the locations of all assets of interest, such as the first responders themselves and any civilians trapped at the disaster site, at any given time. While the Global Positioning System (GPS) provides that functionality in an outdoor environment where one has line-of-sight (LOS) communication with GPS satellites, other solutions are needed for the much harder indoor localization problem. ITL's system relies